Solar Air Heating

Efficient, Simple, Cost Effective
and Building Integrated

Typical Problems with Heating Buildings

- Heat stratification
- Negative Pressure
- Infiltration of cold air
- Lost heat through walls
- Health concerns
- High fuel costs

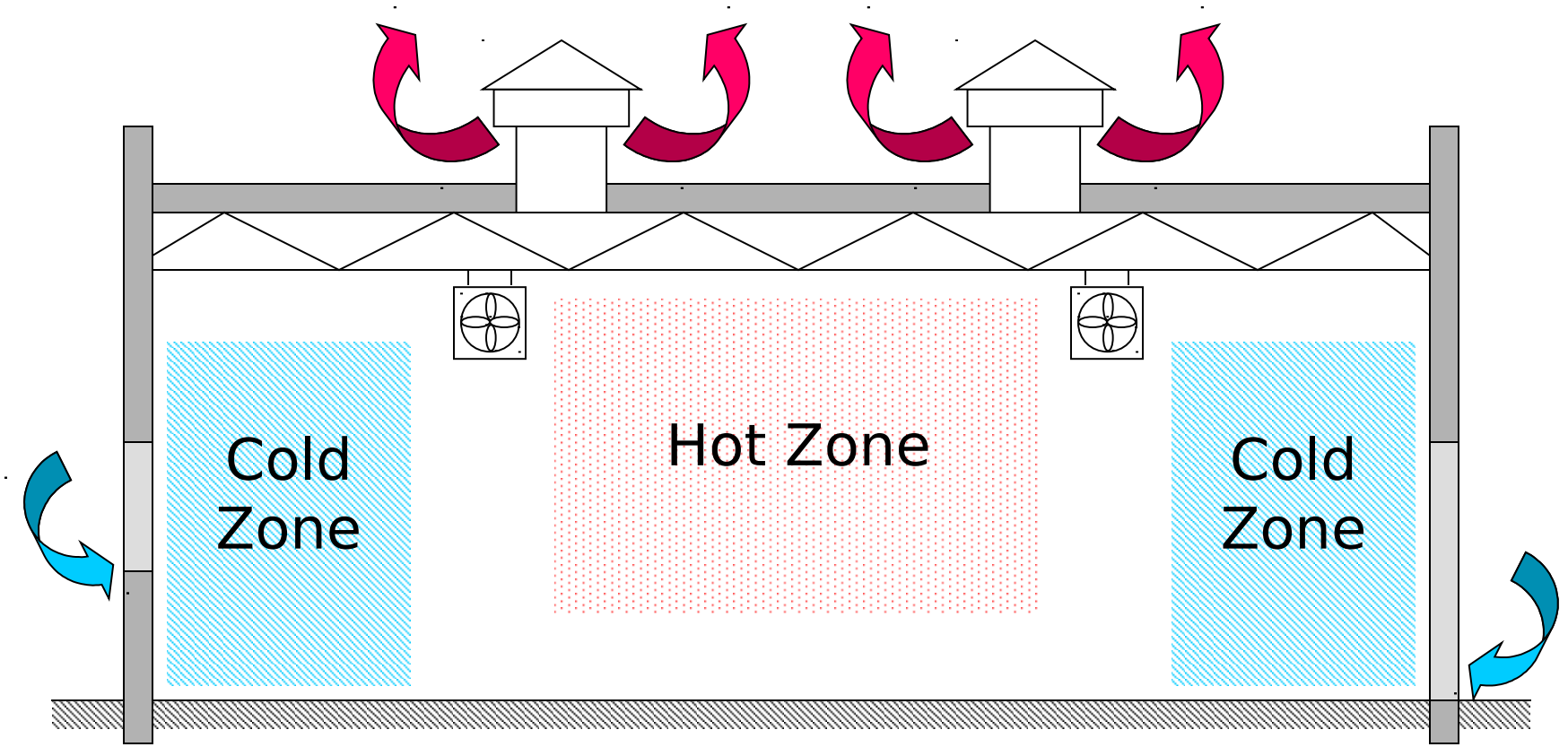
Heat Stratification

- In industrial buildings, heaters are often located near the ceiling to save floor space. Since hot air rises, ceilings become overheated.
- Exhaust fans located on the roof then draw out this overheated air, wasting additional energy

Negative Pressure

- Negative pressure occurs when more air is exhausted than is brought in
- Workers near walls can experience cold drafts from cold air entering along floor level to replace exhausted air
  - Workers tend to compensate by raising the thermostat, which increases energy costs
- Doors become hard to open – serious injury can result from slamming doors
- Back drafting of combustion equipment can create carbon monoxide hazard

Heat Stratification & Negative Pressure



Fans exhaust the hottest air causing cold air to infiltrate at floor level

Buildings Lose Heat through Walls

- Even well-insulated walls lose heat

Health Concerns

- Inadequate fresh air leads to The Sick Building Syndrome (SBS)
  - Symptoms include: headache; eye, nose, skin, or throat irritation; difficulty in concentrating; fatigue; among others
  - “Increasing ventilation rates and air distribution can be a cost effective means of reducing indoor pollutant levels” (U.S. Environmental Protection Agency)

High fuel costs

- Fuel prices are high and are predicted to increase even more
- To save costs, many building managers cut back on fresh air and lower thermostats causing more problems

There is a Solution and it's Here Today

- The fuel is sunlight and it heats fresh air
- The fuel is free, renewable, and non-polluting

Solarwall System Solves Typical Heating Problems

- Panels recover heat loss from wall
- System provides heated fresh air, eliminating negative pressure problems
- Solar fans destratify ceiling heat; increasing occupant comfort and reducing energy costs

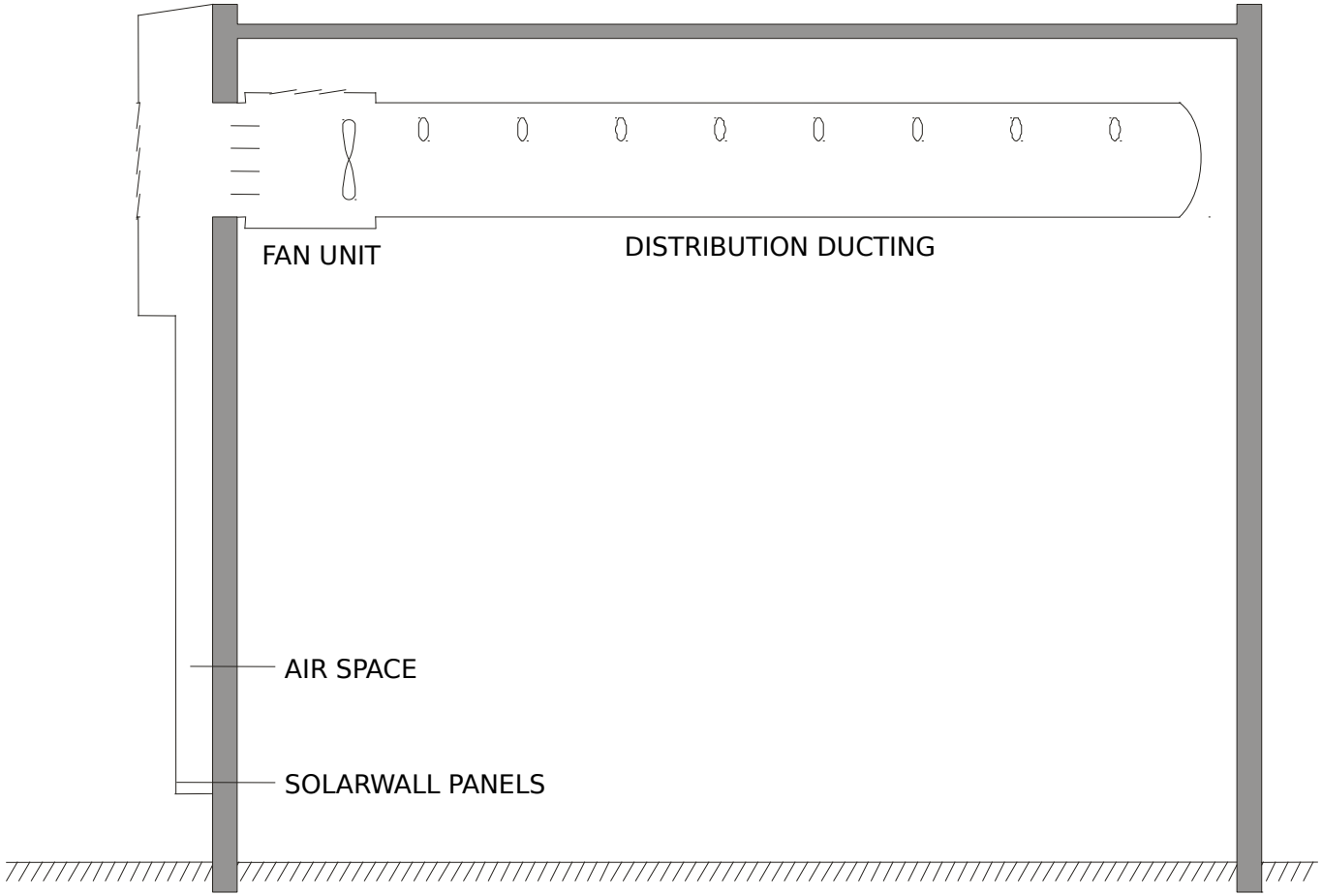
Solarwall Topics

- How the Solarwall system works
- System details
- Solarwall Design
- Government Projects
- Concluding remarks

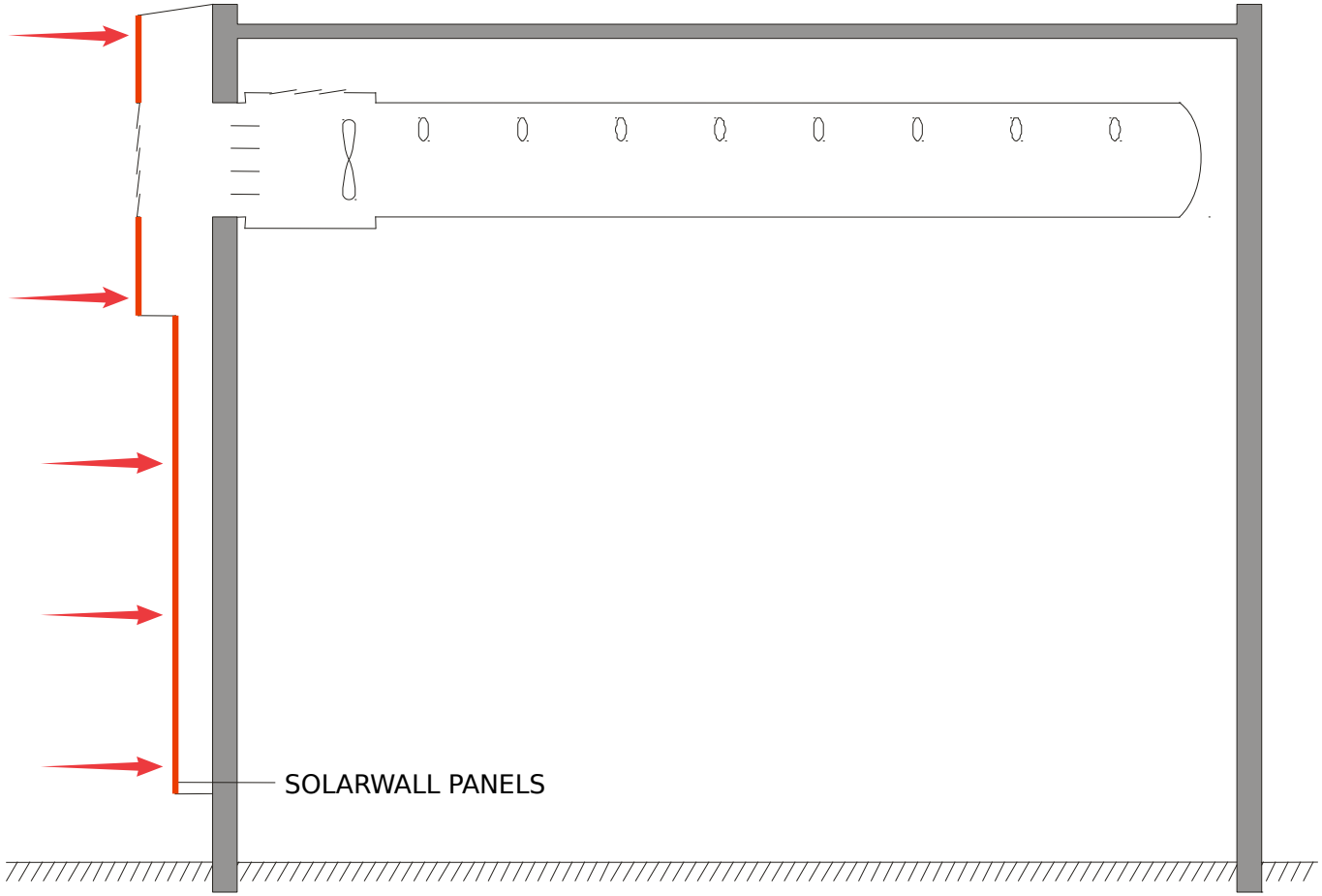
How Solar Air Heating Works

1. Sun shines on the Solarwall panels
2. Air is drawn through tiny perforations
3. Heated air is drawn to the top by a fan and distributed into the building

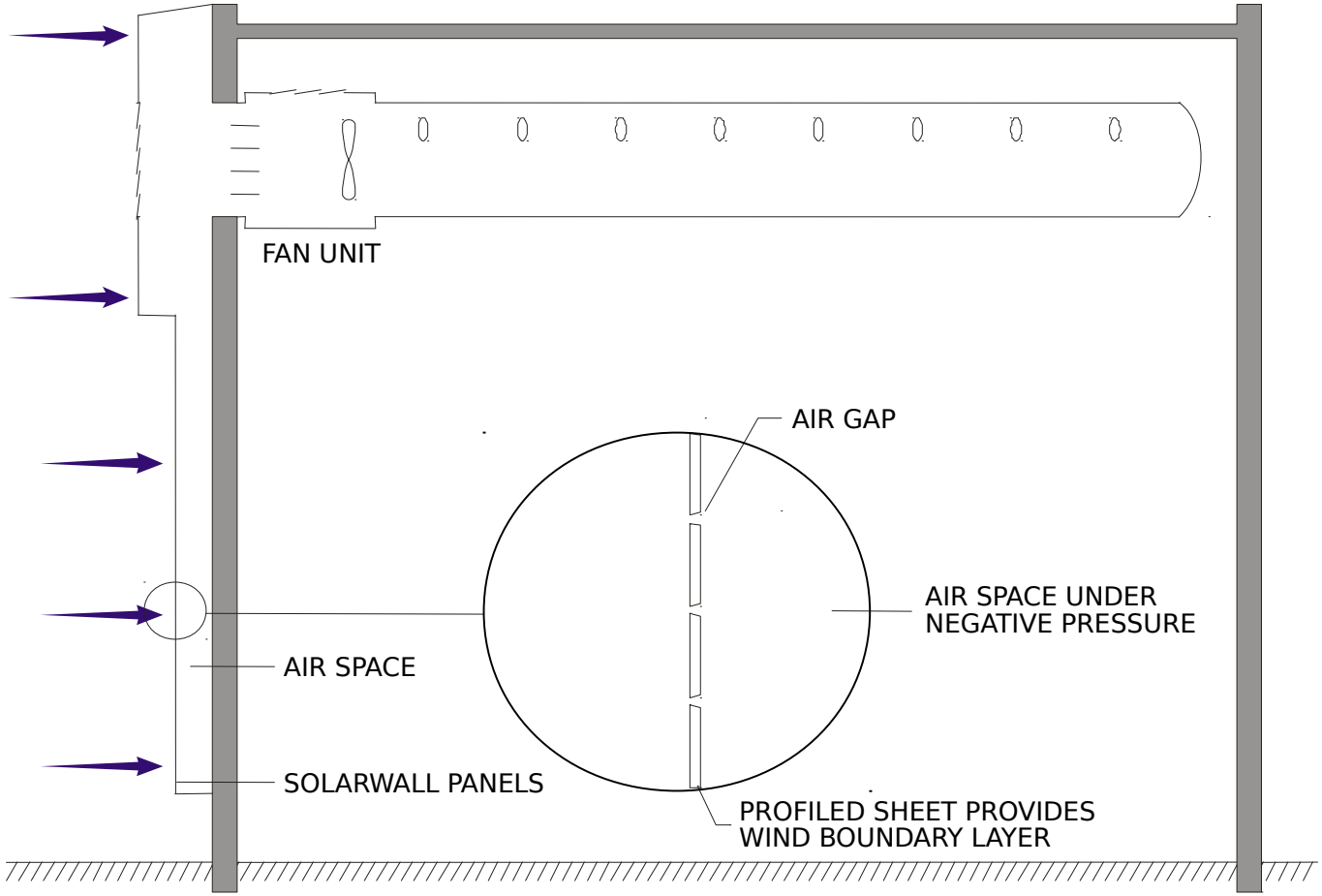
The following animation will help to explain the concept:



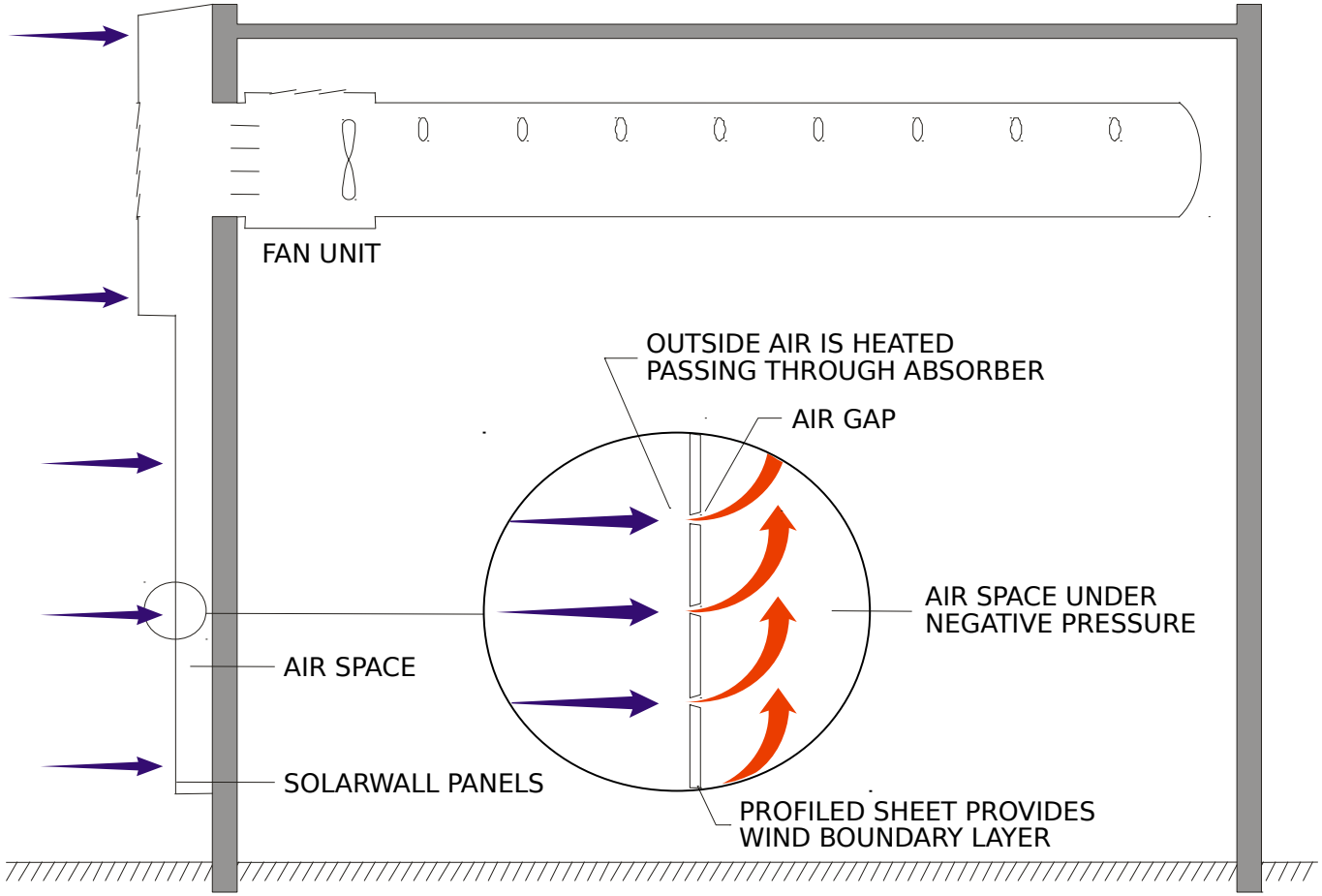
Main components of the Solarwall system



The Solarwall panels absorb the sun’s energy



The panel’s boundary layer allows for air to be heated and drawn through tiny perforations into the air space



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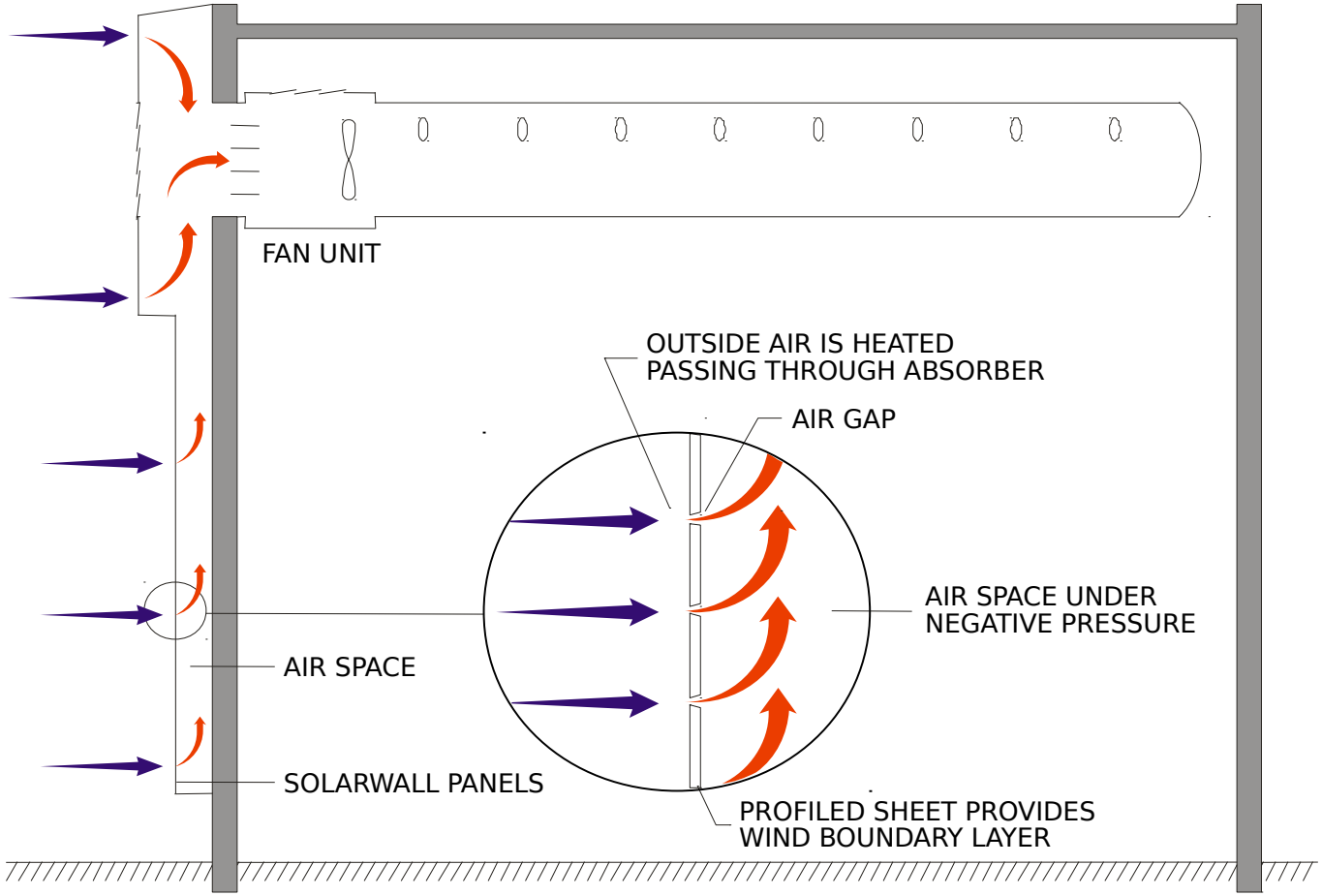
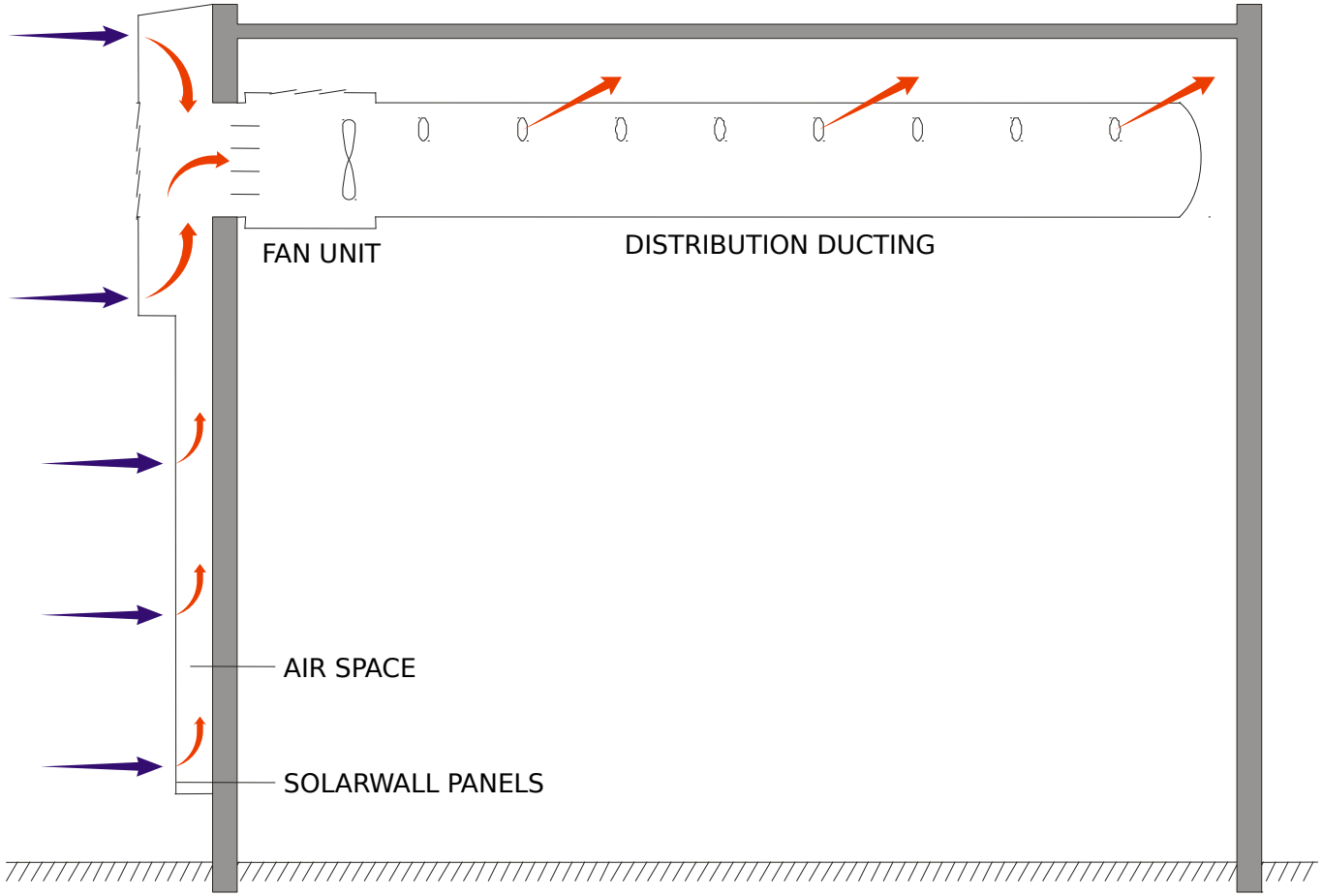
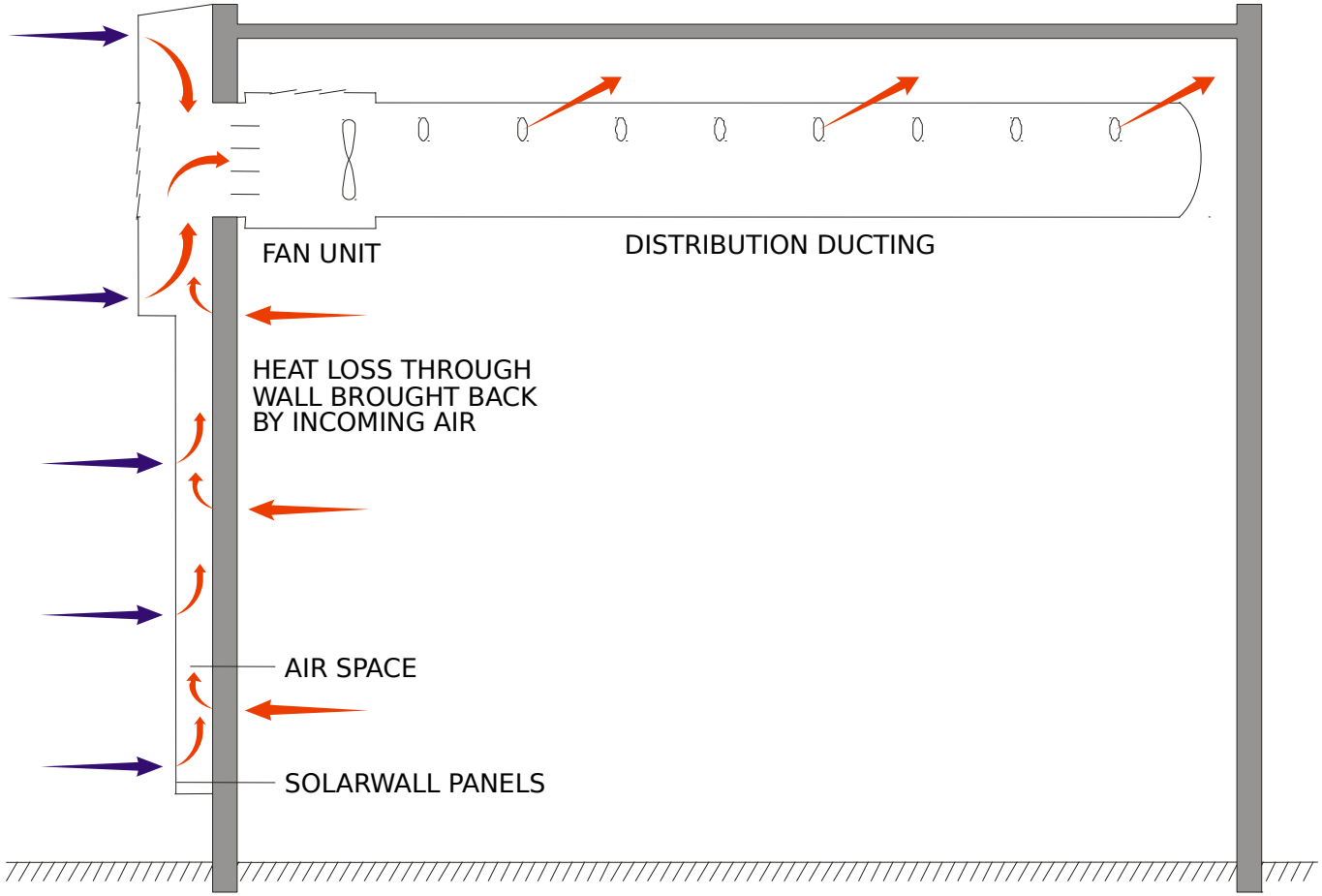


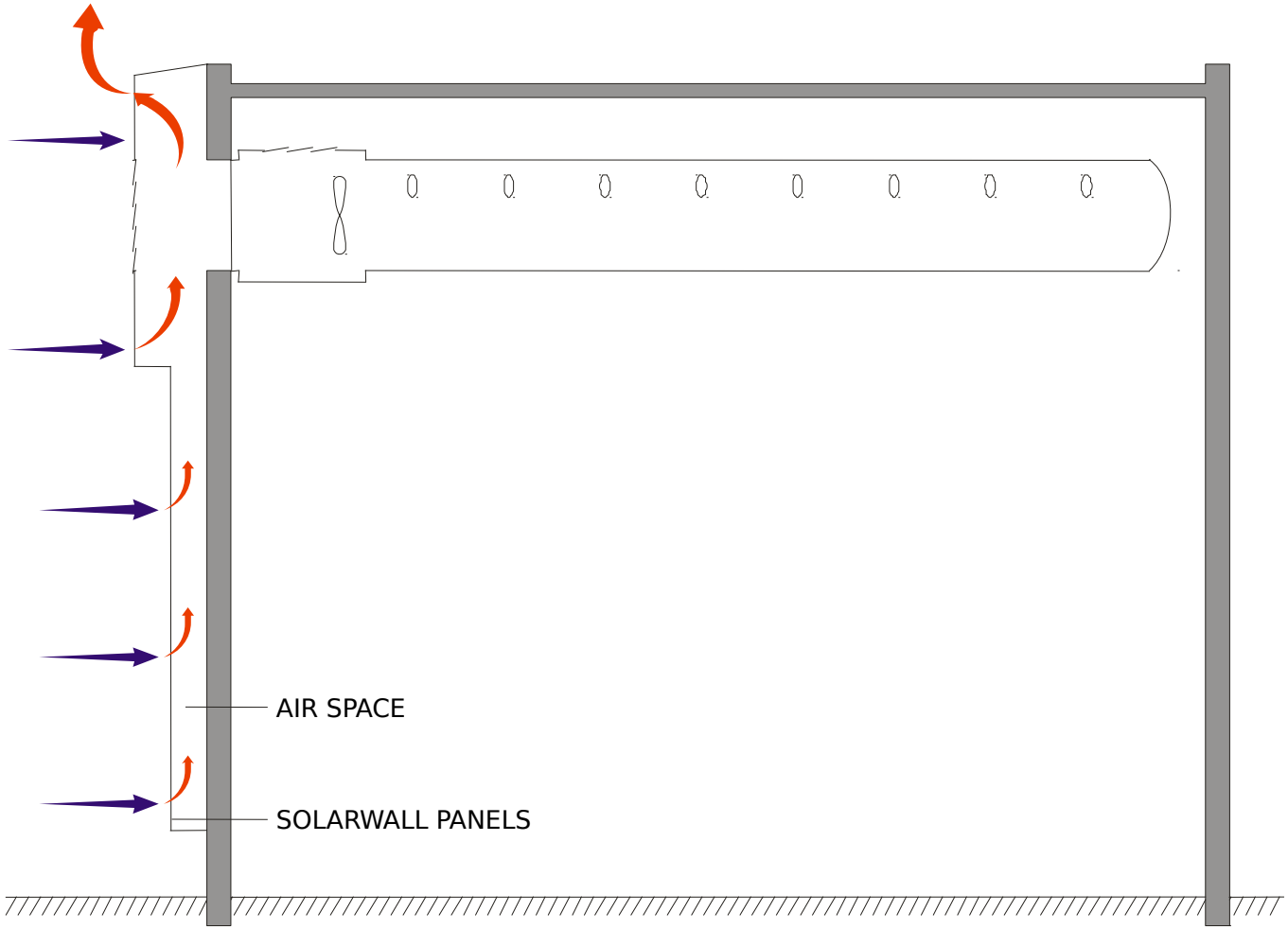
The heated air travels up to the air intake



The heated air, in this example, is then evenly distributed in the building via a perforated duct



Heat loss through the wall is recovered when the fan is running



In the summer, the hot air is vented out the top. Panels act as a sunscreen preventing the sunshine from hitting the wall.

Typical Applications

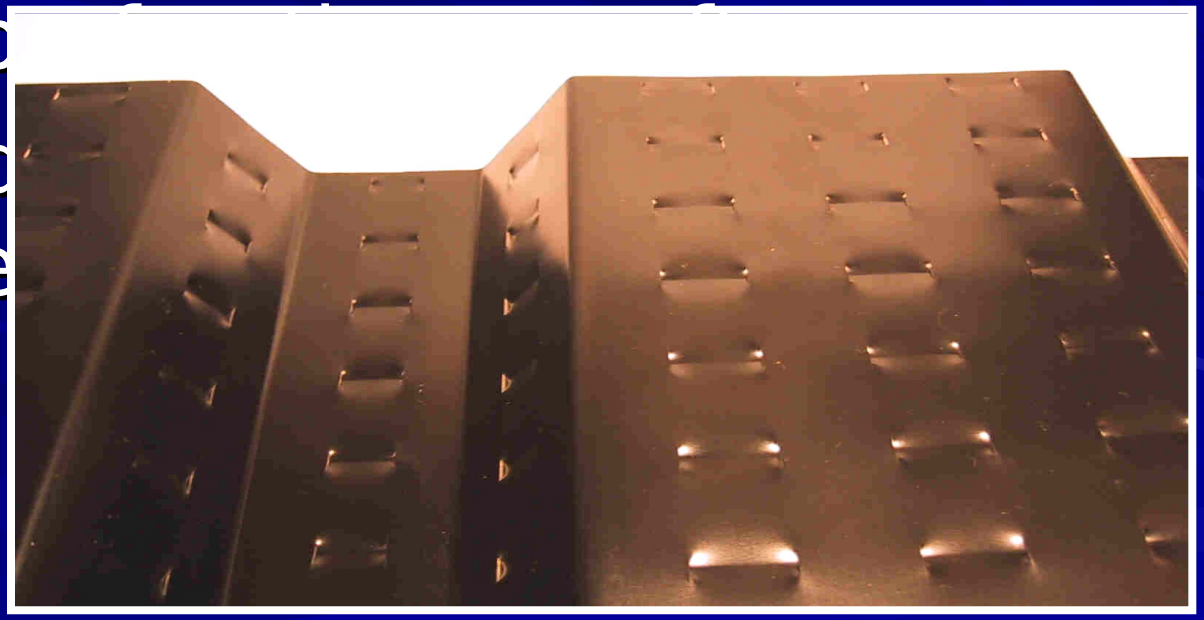
A general rule of thumb is that if your building requires heat, you can benefit from the Solarwall system.

This includes:

- Industrial
- Maintenance Facilities
- Government Buildings
- Process Heating (crop & laundry drying, combustion air)
- Schools
- Retail & Commercial
- Residential (single and multi-unit)

Panel Properties

- Panels can be specified as aluminum or steel
- Wide variety of standard colors available
- Over 240 p
- Corrugated
  to increase
  structural
  rigidity



Typical Installation

- Panels are installed 6 – 12 inches from wall
- Can be installed over or around existing wall openings
- Can be installed over any non-combustible wall material
- Easy installation – no special skills or tools needed

Typical Connections

HVAC intake preheater:

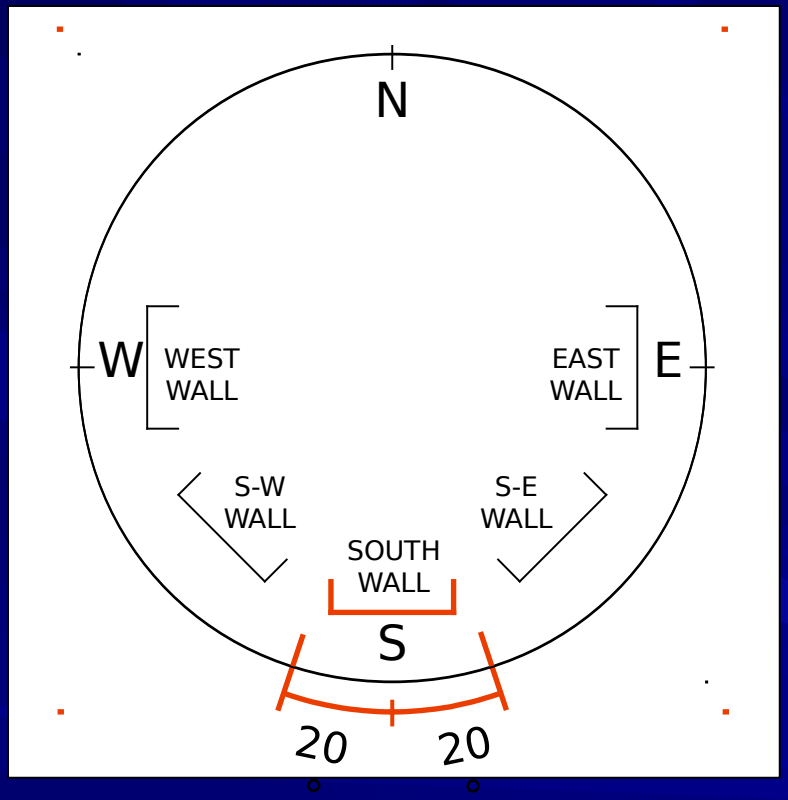
- Preheats air before entering air handler, thus reducing load on conventional heater
- Can be designed to work in a majority of situations, which makes it ideal for retrofit applications

Typical Connections

Heated air supplied directly into building:

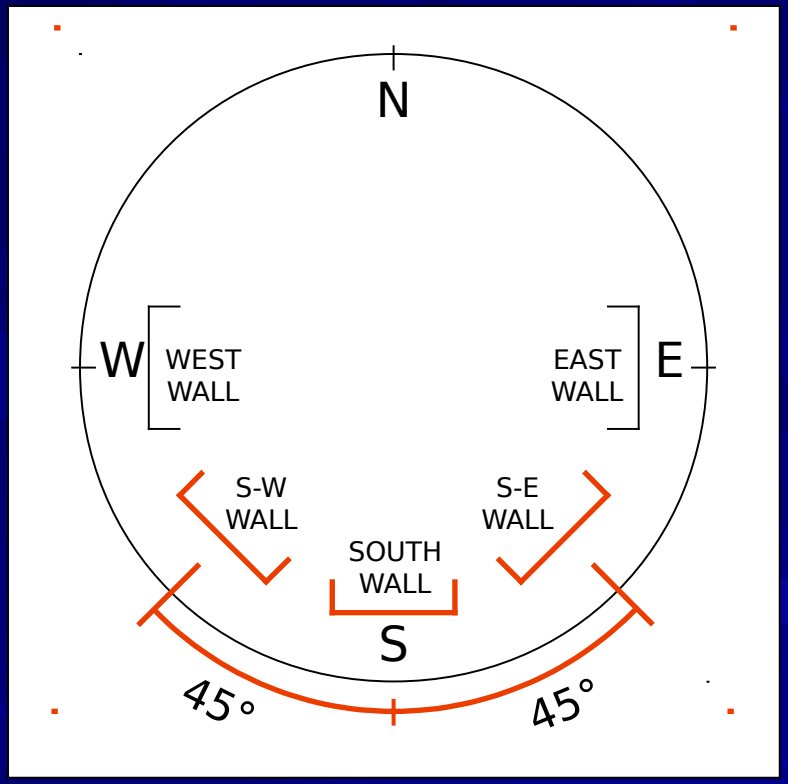
- Solar-heated air is supplied directly to the building via a perforated flexible duct
- Ducting destratifies ceiling heat reducing heating load
- Suitable for both new and retrofit applications

Collector Orientation



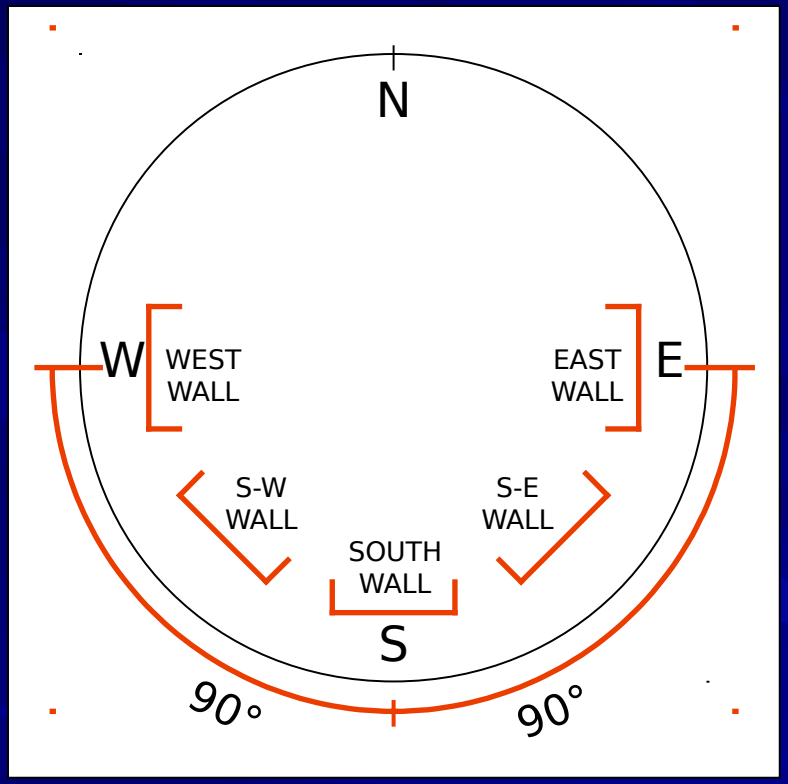
Ideal Orientation ● 96-100% Solar Gain

Collector Orientation



Favorable Orientation ● 80-100% Solar Gain

Collector Orientation



Acceptable Orientation ● East & West facing walls each receive 60% of solar gain

System Design – Step 1

- Decide on panel size and location.
- Is south wall suitable?
  - If not, consider east or west walls.
  - Note that the south wall may actually be south-west, and the east wall would then be south-east. In this case, both walls could be used effectively.

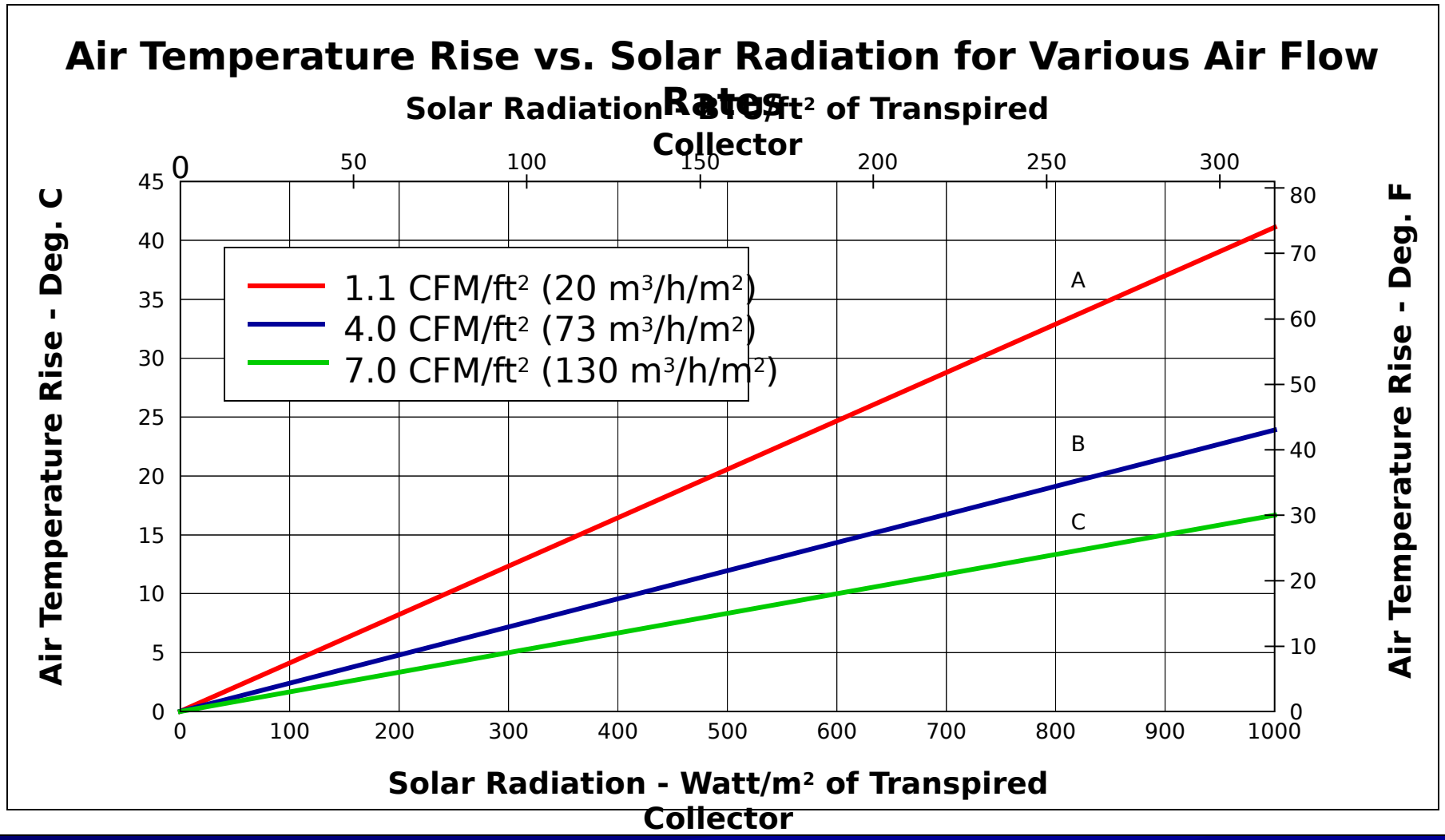
System Design – Step 2

- Determine volume of outside air required in the building
  - Heat as much fresh air as possible
  - This will improve indoor air quality while minimizing fuel costs

System Design – Step 3

- Calculate volume of air per area of solar collector
  - Refer to temperature chart to determine expected temperature rise

Temperature Rise Graph



System Design – Step 4

- Select color and method of connecting to the HVAC units
- If more fresh air is needed, add new wall mounted fans

System Design – Step 5

- Industrial & vehicle maintenance buildings can save more money from destratification
- Determine the amount of ventilation or make-up air required, and then locate the ducting to distribute the air throughout the building.

Environmental Benefits of Solar Air Heating

- System converts the sun's radiation into non-polluting warm air
- Conventional heating system is used less, therefore solar air heating:
  - Reduces energy consumption
  - Reduces greenhouse emissions (~40 lbs (of CO_2) / ft^2 of collector (200 kg/m^2) / annum)

Economics of Solar Air Heating

Average Energy Savings:

- 1.5 - 3.5 therms / ft^2 (of solar collector) / annum (400 – 900 kWh/m2)
- $2 - 8 / ft^2 / annum ($20 – 80/m2)depending on fuel costs)

Typical Payback Periods:

- New construction: 0 - 3 years
- Retrofit: 3 - 7 years

Computer Modeling Software

Natural Resources Canada
Ressources naturelles Canada
Canada
RETScreen® International is a standardised and integrated renewable energy project analysis software. This tool provides a common platform for both decision-support and capacity-building purposes. RETScreen can be used worldwide to evaluate the energy production, life-cycle costs and greenhouse gas emissions reduction for various renewable energy technologies (RETs). RETScreen is made available free-of-charge by the Government of Canada through Natural Resources Canada's CANMET Energy Diversification Research Laboratory (CEDRL). The user is encouraged to properly register at the RETScreen website so that CEDRL can report on the global use of RETScreen.
Solar Air Heating Project Model
TO START (click here)
Brief Description & Model Flow Chart
Cell Colour Coding
RETScreen Features (click to access info)
Online Manual
Product Data
Weather Data
Cost Data
Currency Options
Model Worksheets (click to access sheets)
Energy Model
Solar Resource
Cost Analysis
Greenhouse Gas Analysis
Financial Summary
Blank Worksheets (3)
RETScreen® International
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Internet Options
RETScreen Website
Training Information
Registration
Contact CEDRL
Contributors
85 + Technology Experts
Collaborating Organisations
UNEP
NASA
Version 2000 - Release 2
© Minister of Natural Resources Canada 1997-2000.
NRCan/CEDRL

Free download ● www.retscreen.net

Who has utilized the Solarwall System?

SOLARWALL systems are operating in over twenty countries including numerous federal and local government agencies on a wide variety of applications.

The following are examples of some of the projects:

Fort Huachuca – Fort Huachuca, AZ

Fort Carson – Colorado Springs, CO

Haag - Germany

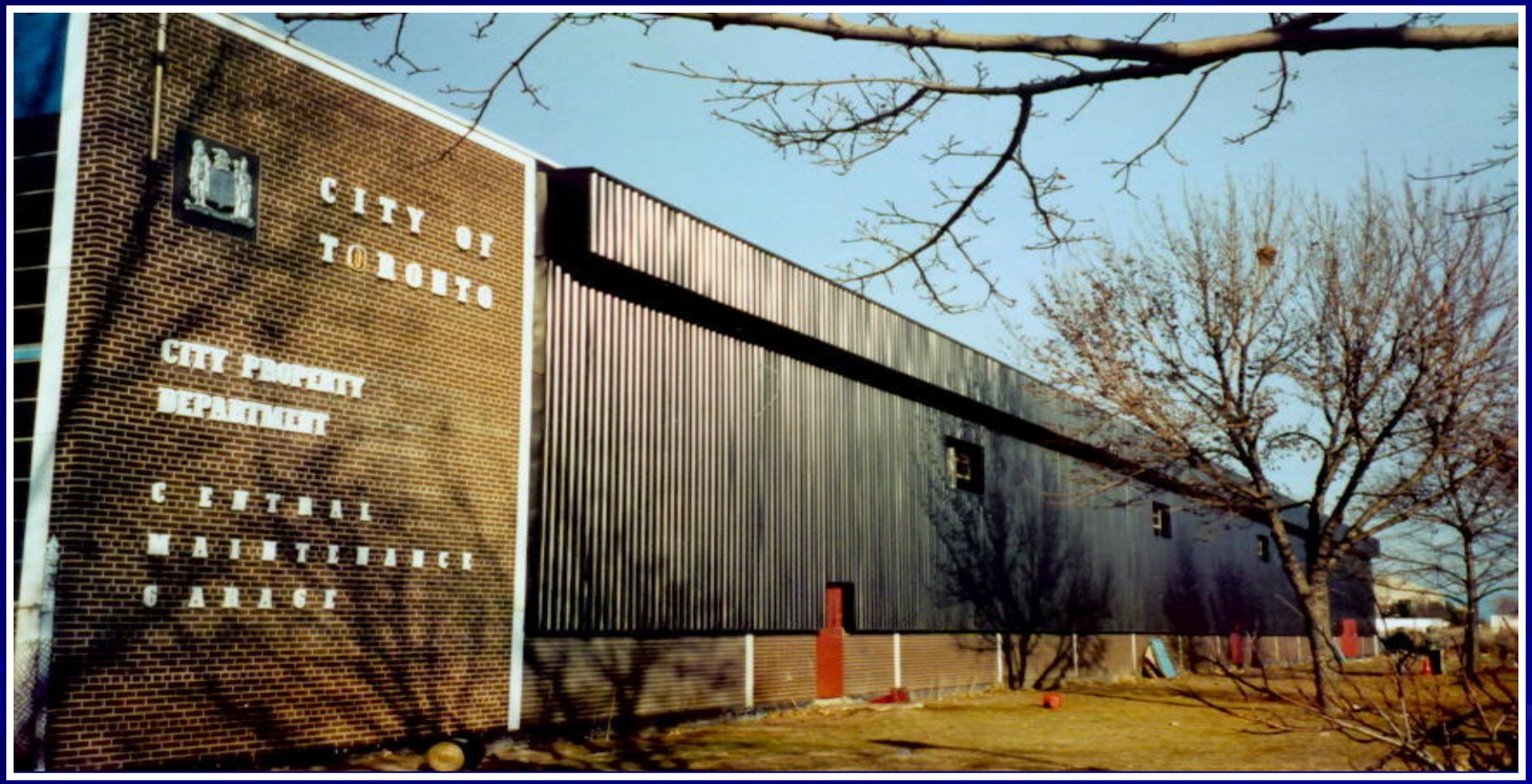
Rapid City Community Center – Rapid City, SD

Environmental Protection Agency (EPA) – Colorado Springs, CO

Thetford Elementary School – Thetford, VT

Sudbury Sewage Treatment Plant –
Sudbury, Ontario

Transit Garage – City of Gera, Germany



City of Toronto Maintenance Garage –
Toronto, Ontario

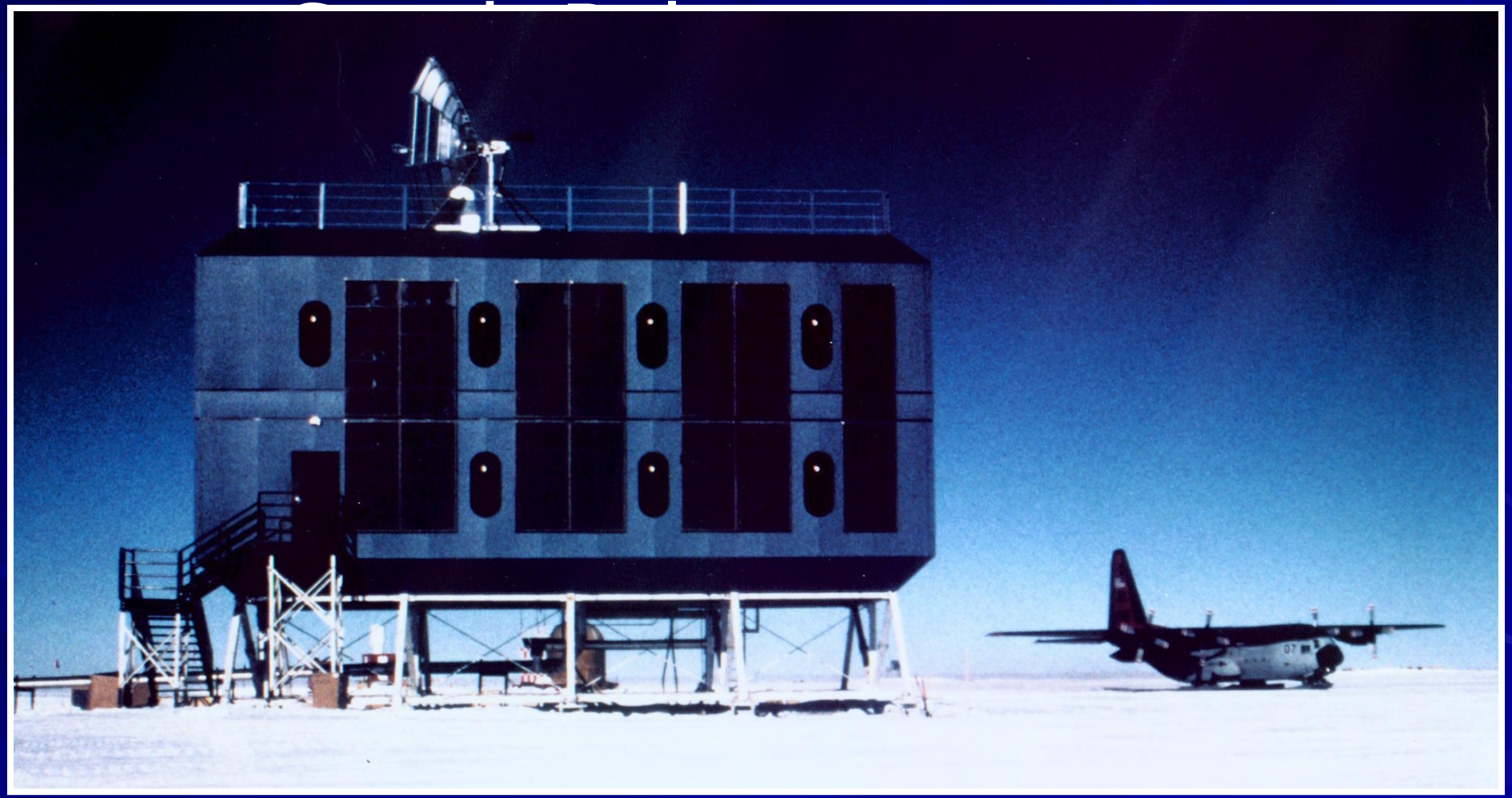
Ecocentre – Italy

Alaittuq High School – Rankin Inlet, Nunavut

NASA – Edwards, CA

Ventilation Air Preheater

National Science Foundation Dormitory,



Endorsements

- “Transpired collectors provide the most reliable, best performing, and lowest cost solar heating for commercial and industrial buildings available on the market today.”
  - (U.S. Department of Energy)

- “It simply works – The simplest, most efficient, and least expensive way to preheat outside air for industrial and commercial applications is through the use of a perforated plate absorber”
  - (Natural Resources Canada)

Solarwall: The Right Choice for Government

- Fuel is renewable and non-polluting
- No maintenance
- Lifetime of free heating
- Potential LEED™ Credits
- Cost effective
- Socially responsible

For more information on solar air heating, please contact:

Conserval Engineering, Inc

www.solarwall.com

National Renewable Energy Laboratory

www.nrel.gov/solar

RETScreen International Simulation Software

www.retscreen.net